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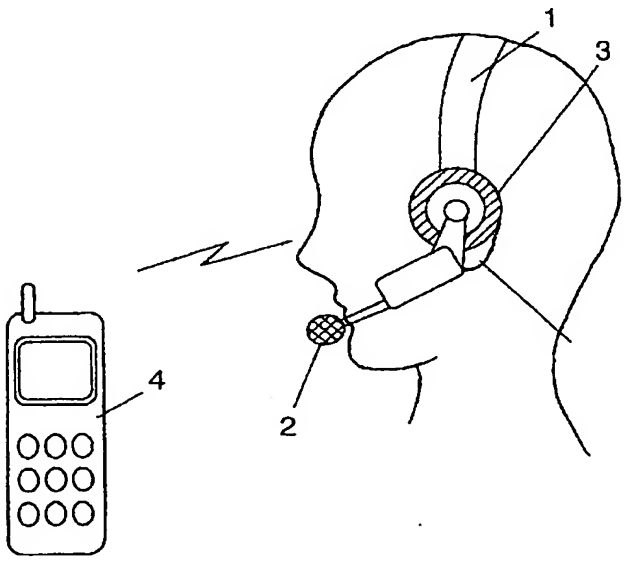
(54) Title: WIRELESS HEADSET AND COMMUNICATION SYSTEM



(57) Abstract: In a headset worn on a user, a user's voice is input to a microphone, and a controller compares an output signal of the microphone and first reference data, and the telephone is set off the hook by the output of the control section. During speech, the controller compares speech data and second reference data, and changes a gain of a second amplifier for driving a loudspeaker according to the difference between the data. When a volume of each of partner's voice and user's voice is smaller than a predetermined volume, the controller outputs a warning sound from the loudspeaker. After a predetermined time lapses, the telephone is set back on hook. In a communication system including the headset and telephone, the headset does not require a speech switch, a voice-volume-increase switch, or a voice-volume-decrease switch. Preferably the headset is a wireless headset using the Bluetooth standard.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

DESCRIPTION

WIRELESS HEADSET AND COMMUNICATION SYSTEM

TECHNICAL FIELD

The present invention relates to a communication terminal such, as a wireless headset, wireless-connected to a communication device, and to a communication system including the terminal, such as an Internet telephone system, a car-mount hands-free system, a credit processing system, and a cash service system.

BACKGROUND ART

Fig. 6 shows a conventional wireless headset system conforming to the Bluetooth standard, which excludes a cable connecting the headset and a cellular telephone. The system includes a wireless headset 100 and a cellular telephone 160 for mutually transmitting and receiving data. The wireless headset 100 includes a microphone 110, a loudspeaker 120, a speech switch 130, a voice-volume-increase switch 140, and a voice-volume-decrease switch 150.

When the cellular phone 160 receives a call, a user must push the speech switch 130 of the wireless headset 100 to set the telephone to off-hook. If a volume level from the loudspeaker 120 is low during service, the user must push the switch 140 at the wireless headset 100 to increase the volume level. If the volume level from the loudspeaker 120 is high, the user must push the switch 150 at the wireless headset 100 to decrease the volume level. When the speech is over, the user must push the speech switch 130 to set the

telephone to on-hook.

Thus, upon start of speech, during speech, and at the end of speech, the user must manipulate the speech switch 130, switch 140, and switch 150 provided in the wireless headset 100 according to circumstances. However, the speech switch 130, switch 140, and switch 150 provided at the wireless headset 100, since being usually arranged in a narrow space, causes an error in manipulation by blind touch.

SUMMARY OF THE INVENTION

A communication terminal is used together with a communication device. The the communication terminal includes a communication section for transmitting and receiving a signal with the communication device, a microphone for sending an input first voice to the communication section, an amplifier for receiving an output of the communication section, an electro-acoustic transducer connected to an output of the amplifier, a storage section for storing first reference data (W), second reference data (Y), third reference data (Z), upper limit reference data, and lower limit reference data being smaller than the upper limit reference data, and a controller. The controller is operable to allow the communication section to transmit a first signal for starting communication at the communication device to the communication device if first data corresponding to a volume of the input first voice is greater than the first reference data (W), to increase a gain of the amplifier according to a difference between the first data and the upper limit reference data if the first data exceeds the upper limit reference data, to set the gain to a predetermined gain if the first data is between the upper limit reference data and lower limit reference data, to decrease the gain according to a difference between the first data and the lower limit reference data if the

first data is smaller than the lower limit reference data, to output a warning if second data transmitted from the communication device through the communication section is smaller than the third reference data (Z) and the first data is smaller than the second reference data (Y), and to allow the communication section to output a second signal for terminating communication with the communication device if the first and second data are smaller than the second reference data (Y) and the third reference data (Z), respectively, when a predetermined time lapses after the warning starts to be output.

This wireless headset does not include a speech switch, a voice-volume-increase switch or a voice-volume-decrease switch which are likely to be mishandled in the prior art.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic diagram of a communication system including a wireless headset and a cellular telephone according to exemplary embodiment 1 of the present invention.

Fig. 2 is a schematic diagram of the wireless headset according to embodiment 1.

Fig. 3 is a schematic diagram of a wireless headset according to exemplary embodiment 2 of the invention.

Fig. 4A is a formant-frequency characteristic diagram of a user used in a wireless headset according to exemplary embodiment 3 of the invention.

Fig. 4B shows difference in each vowel of the formant-frequency characteristic in the wireless headset according to embodiment 3.

Fig. 5 is a schematic diagram of a credit processing system including a wireless headset and a communication device according to exemplary

embodiment 4 of the invention.

Fig. 6 is a schematic diagram of a conventional communication system including a wireless headset and a cellular telephone.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

(Exemplary Embodiment 1)

Fig. 1 is a schematic diagram of a communication system including a wireless headset and a cellular telephone according to exemplary embodiment 1 of the present invention. Fig. 2 is a schematic diagram of the wireless headset. The communication system includes a cellular telephone 4 as a communication device and a wireless headset 1. The wireless headset 1 includes a microphone 2 and a loudspeaker 3 as an electro-acoustic transducer. A communication section 5 performs wireless transmission and reception of data conforming to, for example, the Bluetooth standard with the cellular telephone 4. A voice compression/decompression unit (CODEC) 6 is connected to the communication section 5, and a first amplifier 7 is connected to the voice CODEC 6. The microphone 2 is connected to the first amplifier 7. A loudspeaker 3 is connected to a second amplifier 8 connected to the voice CODEC 6. A storage section 10 is connected to a controller 9 connected to the communication section 5. An analog-digital (A/D) converter 11 is provided between the controller 9 and the first amplifier 7. A digital-analog (D/A) converter 12 is connected between the controller 9 and the second amplifier 8.

An off-hook operation in the wireless headset 1 for starting communication by using the cellular telephone 4 will be explained. The storage section 10 preliminarily stores predetermined first reference data (W), basic data (X), allowable data (ε), second reference data (Y), and third

reference data (Z). The controller 9 determines fifth reference data (X-ε) and sixth reference data (X+ε) on the basis of the basic data (X) and the allowable data (ε) stored in the storage section 10. The communication section 5 receives an incoming signal from the cellular telephone 4, and sends a signal corresponding to this incoming signal into the voice CODEC 6. The voice CODEC 6 sends an output signal to the second amplifier 8, and the second amplifier 8 amplifies this signal, and drives the loudspeaker 3. Upon the loudspeaker 3 being driven, a user speaks to the microphone 2, and the signal corresponding to this voice is issued from the microphone 2 into the first amplifier 7. The output signal of the first amplifier 7 is A/D-converted by the A/D converter 11. The controller 9 compares the volume of a voice of the user with the first reference data (W) stored in the storage section 10 based on voice data output by the A/D converter 11. When the volume is greater than the first reference data (W), the controller 9 outputs an off-hook signal for starting communication with the cellular telephone 4 to the communication section 5, that is, for setting the cellular telephone 4 to off-hook, and sets the telephone 4 to a speech mode. This eliminates a speech switch for setting a conventional telephone to off-hook is no longer needed.

An operation of the communication system in the speech mode will be explained. After the speech mode starts, the voice of the user is input to the microphone 2 and is further sent to the first amplifier 7. The A/D converter 11 A/D-converts the output of the first amplifier 7. The controller 9 compares a speech data corresponding to the volume of the A/D converted voice with the fifth and sixth reference data. When the speech data exceeds the sixth reference data (X+ε), the controller 9 increases a gain of the second amplifier 8 for driving the loudspeaker 3 according to the difference between

the speech data and the sixth reference data (X+ε), i.e., upper limit data. When the speech data is between the fifth reference data (X-ε), i.e., lower limit data, and the sixth reference data (X+ε), the controller 9 sets the gain of the second amplifiers 8 to a predetermined gain. When the speech data is smaller than the fifth reference data (X-ε), the controller 9 decreases the gain of the second amplifier 8 according to the difference between the speech data and the data (X-ε). This operation eliminates hitherto-required voice-volume-increase switch and voice-volume-decrease switch are no longer needed.

A communication terminating procedure in the wireless headset through the cellular telephone 4 in the speech mode, that is, an on-hook operation for setting the cellular telephone 4 to on-hook will be explained. The voice of the user from the microphone 2 is input to the first amplifier 7, and the output of the first amplifier 7 is A/D-converted by the A/D converter 11. The controller 9 compares speech data corresponding to the volume of the A/D-converted voice with the second reference data (Y) stored in the storage section 10. The controller 9 then compares voice data corresponding to the volume of the voice transmitted from the cellular telephone 4 through the communication section 5 with the third reference data (Z) stored in the storage section 10. When the speech data and voice data are smaller than the second reference data (Y) and third reference data (Z), respectively, the controller 9 outputs a warning sound to the user through the loudspeaker 3. When a predetermined time lapses after the warning sound is output, and when the speech data and voice data are still smaller than the second reference data (Y) and third reference data (Z), respectively, the controller 9 sends an on-hook signal to the communication section 5 for terminating the communication through the cellular telephone 4, that is, for setting the

cellular telephone 4 to on-hook. This operation eliminates a speech switch in a conventional telephone to be set to on-hook is no longer needed.

Having such configuration, the wireless headset of embodiment 1 does not require the speech switch, the voice-volume-increase switch, or the voice-volume-decrease switch.

According to embodiment 1, the controller 9 may compare an average per unit time of the speech data of the user with the fifth reference data (X-ε) and sixth reference data (X+ε). When the average is not between the fifth reference data (X-ε) and the sixth reference data (X+ε), the controller 9 updates the basic data (X) into the average. When the average is between the fifth reference data (X-ε) and the sixth reference data (X+ε), the control section 9 does not update the basic data (X). This operation prevents the gain of the second amplifier 8 for driving the loudspeaker 3 from changing due to sudden increase or decrease of voice volume of the user.

According to embodiment 1, a call mode, for calling the user, preliminarily selected in the cellular telephone 4 may be sent to the communication section 5 of the wireless headset 1 through the cellular telephone 4. The call mode may be stored in the storage section 10. This arrangement eliminates a switch for selecting the call mode in the wireless headset 1.

According to embodiment 1, a loudspeaker having a vibrating function as the electro-acoustic transducer allows the headset to call the user in the call mode, i.e., either by vibration or incoming sound, according to environment.

According to embodiment 1, a bone conduction microphone, upon being used as the microphone, decreases a noise input into the microphone.

(Exemplary Embodiment 2)

Fig. 3 is a schematic diagram of a wireless headset according to exemplary embodiment 2 of the invention. In embodiment 2, the same element as in embodiment 1 are denoted by the same reference numerals, and is not described in detail. A wireless headset 20 has a bone conduction loudspeaker 21. The bone conduction loudspeaker 21, upon being used as an electro-acoustic transducer, allows the ear of the user not to be closed for transmitting a voice sent from the cellular telephone 4 to a user through a communication section 5. This allows the user to feel free, and allows the user to react quickly in case of emergency information or other information. The bone conduction loudspeaker 21 may be placed at a position around the ear, not limited to a position ahead of the ear. The bone conduction loudspeaker 21, upon being placed so as to apply pressure to the head of the user, enhances the efficiency of transmitting voice to the user.

(Exemplary Embodiment 3)

Fig. 4A and Fig. 4B are formant-frequency characteristic diagrams of a user used in a wireless headset according to exemplary embodiment 3 of the invention. Fig. 4A shows first, second, and third formant frequencies each expressing a consonant portion, a transition portion from the consonant portion to a vowel portion, and the vowel portion of a voice of the user. Fig. 4B shows the first, second, and third formant frequencies of each of vowels, "i", "e", "a", "o", and "u". Characteristics of the first, second, and third formant frequencies vary depending on each user, thus being utilized in the wireless headset according to embodiment 1.

An operation of this arrangement will be explained.

The voice of the user is transmitted through the microphone 2, first

amplifier 7, and A/D converter 11, and a frequency spectrum of the voice is analyzed in the controller 9. The controller 9 registers data of the analyzed voice in the storage section 19 as formant-frequency data. This arrangement allows the headset according to embodiment 3 to perform various processes on the basis of the formant-frequency data specifying the user.

An operation for the processes will be explained in detail

The controller 9 processes the formant-frequency data stored in the storage section 10 to provide a 128-bit personal identification number (PIN) code. Upon being utilized in authentication for wireless connection between the wireless headset 1 and the cellular telephone 4 conforming to the Bluetooth standard, the PIN code provides a connection authentication with high security without any particular input device or peripheral device for inputting the PIN code.

After the cellular telephone is changed to a speech mode, the frequency spectrum of the voice of the user transmitted through a microphone 2, a first amplifier 7 and an A/D converter 11 may be analyzed by the controller 9. The controller 9 compares the analyzed data with the formant-frequency data of the user stored in the storage section 10. When the analyzed data includes the stored formant-frequency data, the controller 9 may a gain of a second amplifier 8 for driving the loudspeaker 3 depending on the volume of the voice of the user.

(Exemplary Embodiment 4)

Fig. 5 is a schematic diagram of a communication system for credit processing including a wireless headset and a communication device according to exemplary embodiment 4 of the invention. In embodiment 4,

the same elements as in embodiment 1 are denoted by the same reference numerals, and are not described in detail.

The system including a wireless headset 1 and a terminal device 31 which is installed at a register counter 30 for credit processing as a communication device wireless-connected to the wireless headset 1 conforming to the Bluetooth standard. In the credit processing system, a Bluetooth address is used as a personal identification number for the credit processing, allows the user not only to make voice and data communications utilizing features of the Bluetooth standard, but also to enloy shopping quickly at a store without a credit card or the like.

The communication system of embodiment 4 may includes a wireless headset and a communication device having a cash service processing function of wireless connection conforming to the Bluetooth standard instead of the terminal device 31 for credit processing. In this system, the Bluetooth address is used as a personal identification number for receiving cash service. Further, the PIN code may be used as a password for receiving cash service, thus providing a cash service system capable of not only communicating voice and data conforming to the Bluetooth standard, but also providing prompt and high security cash service without a credit card.

The wireless headset according to embodiments 1 to 3 may be incorporated in a helmet, thus allowing the user to wear the helmet when both hands are occupied during work, and voice and data communication is realized without requiring switch manipulation.

In an Internet telephone system including the wireless headset according to embodiments 1 to 3 and the communication device wireless-connected to the wireless headset having an Internet telephone function, the user can make a telephone call without manipulating a switch on the

wireless headset by hand while working with both hands.

In a vehicle hands-free system for motorcycles or automobiles including the wireless headset according to embodiments 1 to 3 and the communication device wireless-connected to the wireless headset having a telephone function, the user can make voice and data communications without manipulating a switch on the wireless headset by hand while driving the vehicle. In particular, a wireless headset having a bone conduction loudspeaker allows the user to feel free and to react quickly in case of emergency information or other information.

In embodiments 1 to 4, the cellular telephone, terminal device for credit processing, and terminal device for cash service are explained as the communication device, but not limited to them, the technique is applicable to various communication device, such as a PDA, a personal computer, a small portable terminal.

In embodiments 1 to 4, the wireless connection between the wireless headset system and the communication device is considered to be only the Bluetooth standard, but not limited to this. The connection may conform to other wireless connection standards, such as IEEE802.11a, IEEE802.11b, or IEEE wireless 1394 standard. As a result, high speed communication of voice and data is realized.

In embodiments 1 to 4, the wireless headset may be any portable wireless-communication terminal and a wired communication terminal connected to the communication device.

INDUSTRIAL APPLICABILITY

As described herein, the invention provides a wireless communication terminal not requiring a speech switch, a voice-volume-increase switch, or a

voice-volume-decrease switch.

CLAIMS

1. A communication terminal used together with a communication device, said communication terminal comprising:

a communication section for transmitting and receiving a signal with said communication device;

a microphone for sending an input first voice to said communication section;

an amplifier for receiving an output of said communication section;

an electro-acoustic transducer connected to an output of said amplifier;

a storage section for storing first reference data (W), second reference data (Y), third reference data (Z), upper limit reference data, and lower limit reference data being smaller than said upper limit reference data; and

a controller operable to:

allow said communication section to transmit a first signal for starting communication at said communication device to said communication device if first data corresponding to a volume of said input first voice is greater than said first reference data (W);

increase a gain of said amplifier according to a difference between said first data and said upper limit reference data if said first data exceeds said upper limit reference data;

set said gain to a predetermined gain if said first data is between said upper limit reference data and lower limit reference data;

decrease said gain according to a difference between said first data and said lower limit reference data if said first data is smaller

than said lower limit reference data;

output a warning if second data transmitted from said communication device through said communication section is smaller than said third reference data (Z) and said first data is smaller than said second reference data (Y); and

allow said communication section to output a second signal for terminating communication with said communication device if said first and second data are smaller than said second reference data (Y) and said third reference data (Z), respectively, when a predetermined time lapses after said warning starts to be output.

2. The communication terminal of claim 1,

wherein said storing section stores basic data (X) and allowable data (ε), and

wherein said controller is operable to determine said lower limit reference data and said upper limit reference data as fifth reference data (X-ε) and sixth reference data (X+ε) with using said basic data (X) and said allowable data (ε), respectively.

3. The communication terminal of claim 2, wherein said controller is operable to update said basic data (X) according to said first data.

4. The communication terminal of claim 3, wherein said controller is operable to:

determine an average per a certain time of said first data,

update said basic data (X) to said average if said average is not between said fifth reference data (X-ε) and said sixth reference data (X+ε),

and

maintain said basic data (X) if said average is between said fifth reference data (X-ε) and said sixth reference data (X+ε).

5. The communication terminal of claim 1, wherein said electro-acoustic transducer comprises a bone conduction loudspeaker.

6. The communication terminal of claim 5, wherein said bone conduction loudspeaker is located near an ear of a user.

7. The communication terminal of claim 6, wherein said bone conduction loudspeaker is located so as to pressurize a head of said user.

8. The communication terminal of claim 1, wherein said controller is operable to:

analyze a frequency spectrum of a second voice input through said microphone, and

determine first formant-frequency data based on said analyzed frequency spectrum of said second voice

9. The communication terminal of claim 8, wherein said control section is operable to register said determined first formant frequency data in said storage section.

10. The communication terminal of claim 9, wherein said control section is operable to

analyze a frequency spectrum of said first voice to determine

second formant frequency data, and

adjust said gain according to said first data if said second formant frequency data includes said first formant frequency data.

11. The communication terminal of claim 8, wherein said first formant frequency data is utilized as a personal identification number (PIN) code.

12. The communication terminal of claim 11,

wherein said communication section transmits and receives a signal with said communication device by wireless conforming to the Bluetooth standard, and

wherein said communication device comprises a cash service processing function using a Bluetooth address as a personal identification number when receiving cash service, and using said PIN code as a password when receiving said cash service.

13. The communication terminal of claim 11, wherein said control section is operable to determine said PIN code based on said first formant frequency data.

14. The communication terminal of claim 1, wherein said communication section transmits and receives a signal with said communication device by wireless.

15. The communication terminal of claim 14, wherein said communication section transmits and receives a signal with said

communication device by wireless conforming to the Bluetooth standard.

16. The communication terminal of claim 15, wherein said communication section comprises a credit processing function using a Bluetooth address as a personal identification number for credit processing.

17. The communication terminal of claim 14, wherein said communication section transmits and receives a signal with said communication device by wireless conforming to one of the IEEE802.11a standard, the IEEE802.11b standard, and the IEEE wireless 1394 standard.

18. The communication terminal of claim 1, wherein said microphone comprises a bone conduction microphone.

19. The communication terminal of claim 1,

wherein said communication device transmits third data indicating a call mode for informing a user of an incoming call to said communication section, and

wherein said control section is operable to store said transmitted third data in said storage section.

20. The communication terminal of claim 19, wherein said call mode informs said user of said incoming call by one of vibration and an incoming sound.

21. A helmet comprising:

said communication terminal of claim 1; and

a helmet main body having said communication terminal mounted thereto.

22. An Internet telephone system comprising:

said communication terminal of claim 1; and

said communication device,

wherein said communication device has an Internet telephone function.

23. A vehicle hands-free system comprising:

said communication terminal of claim 1; and

said communication device.

24. A communication system comprising:

said communication terminal of claim 11, and

said communication device,

wherein said communication device uses said PIN code based on said first formant frequency data for an authentication at a wireless connection with said communication terminal.

25. A cash service system comprising:

said communication terminal of claim 11; and

said communication device,

wherein said communication device has a cash service processing function using a Bluetooth address as a personal identification number when receiving cash service, and using said PIN code as a password when receiving said cash service.

26. A credit processing system comprising:

said communication terminal of claim 12; and

said communication device.

FIG. 1

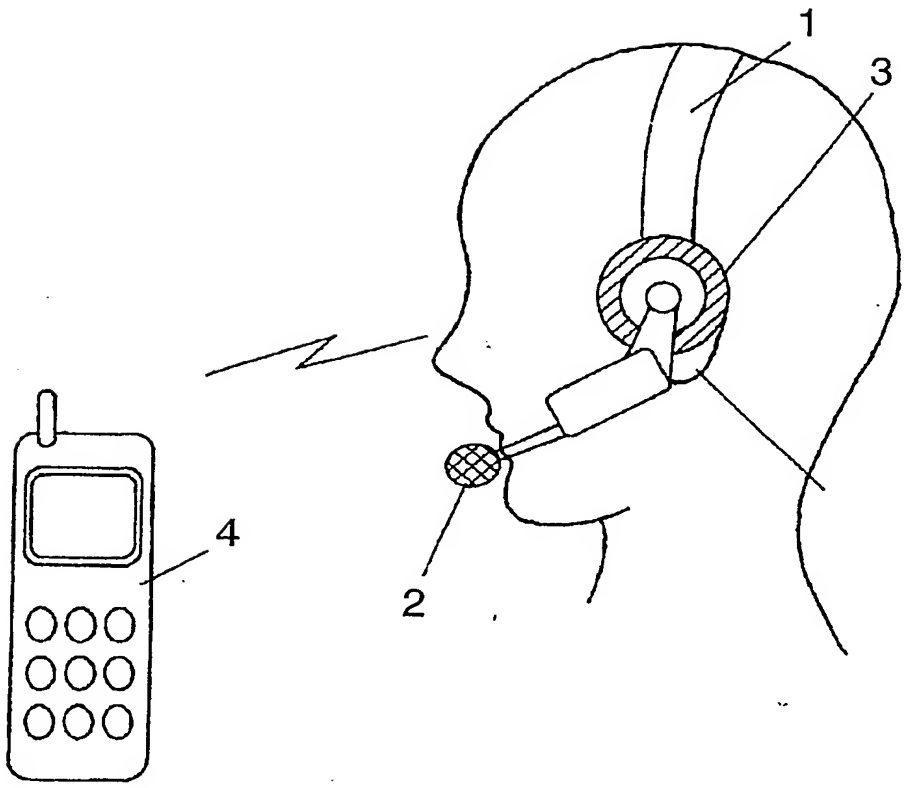


FIG. 2

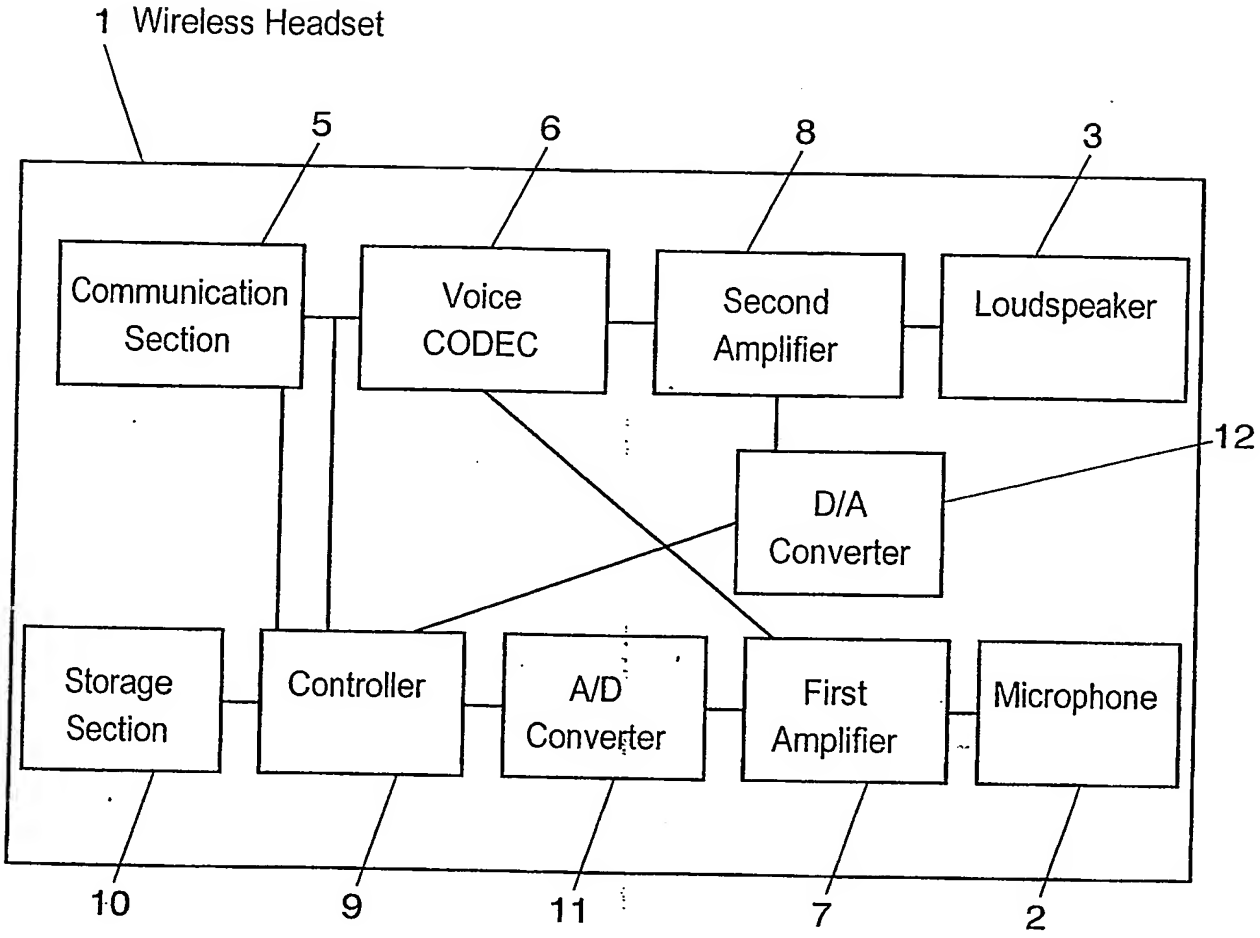

1 Wireless Headset
5
6
8
3
Communication Section
Voice CODEC
Second Amplifier
Loudspeaker
12
D/A Converter
Storage Section
Controller
A/D Converter
First Amplifier
Microphone
10
9
11
7
2

FIG. 3

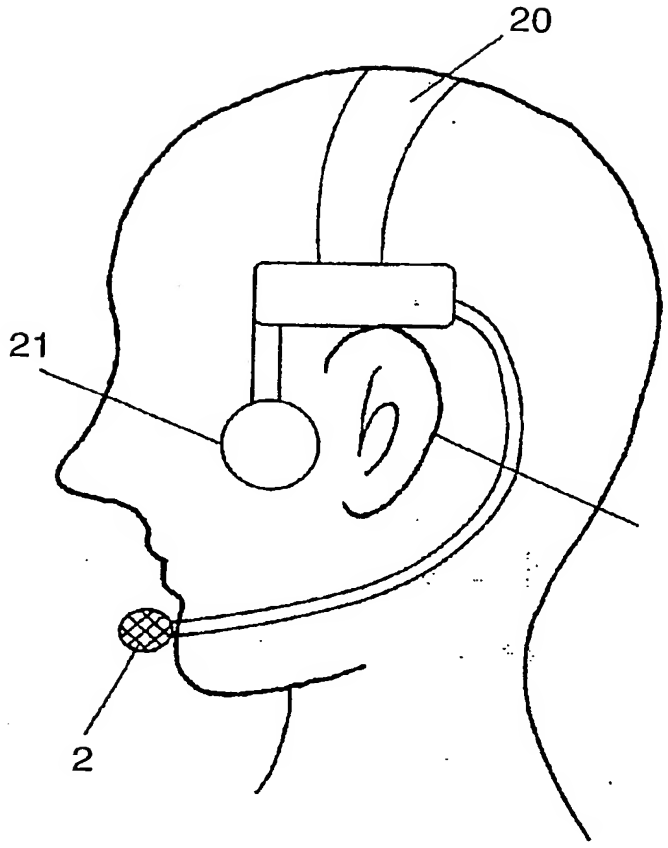


FIG. 4B

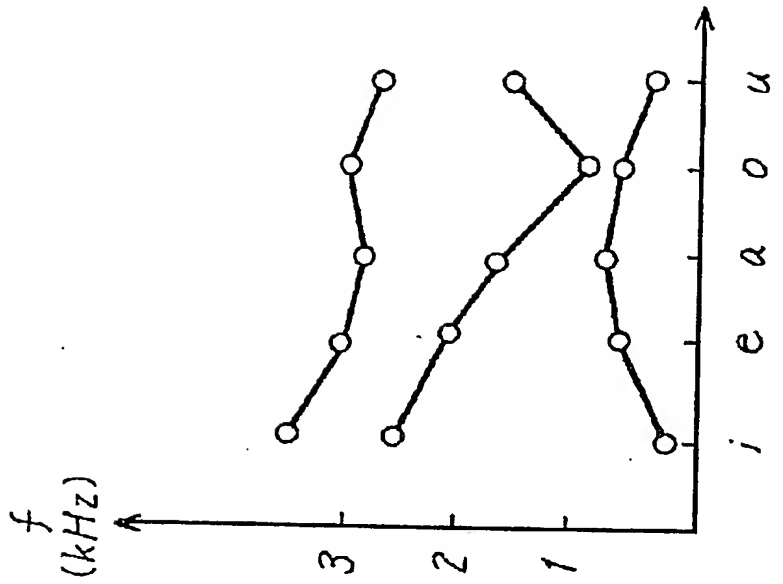


FIG. 4A

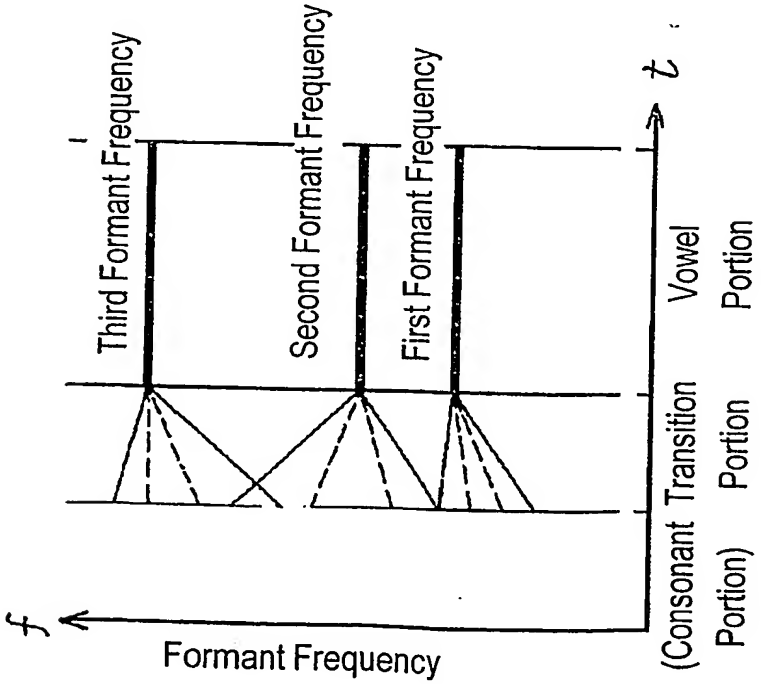


FIG. 5

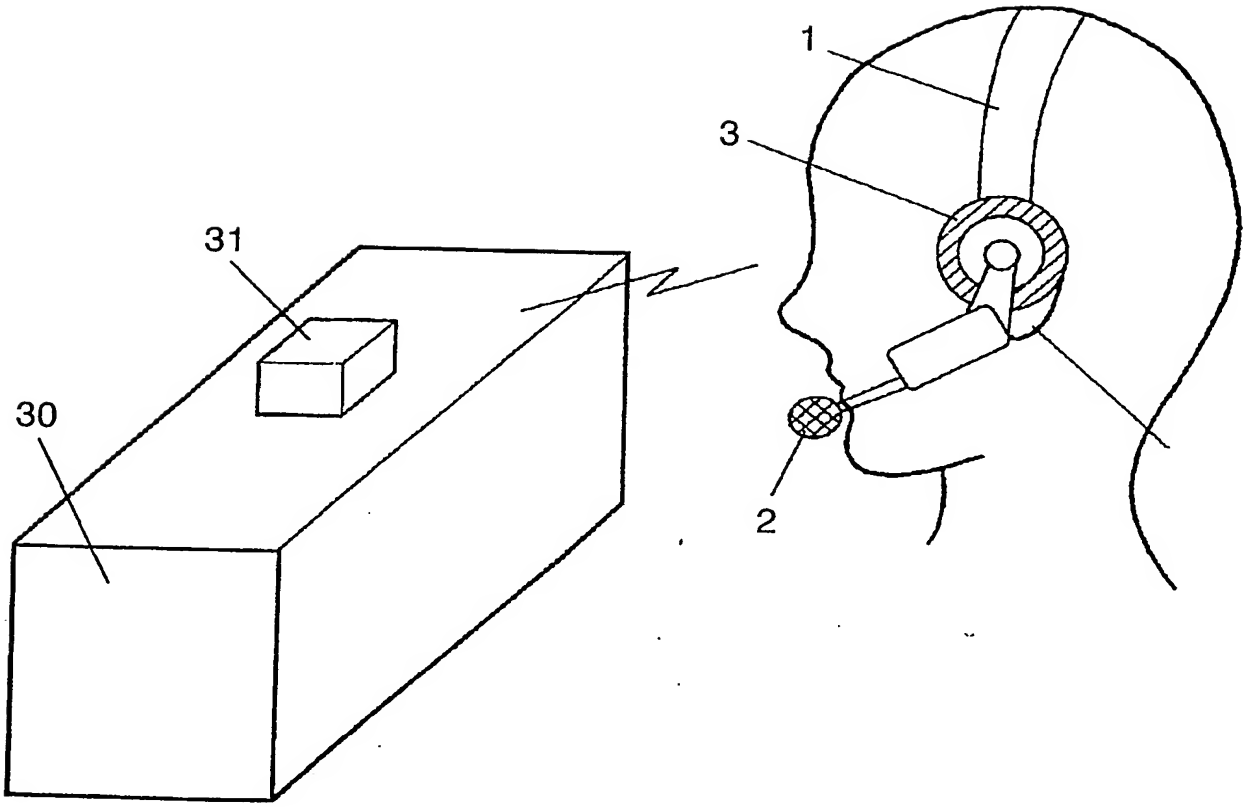
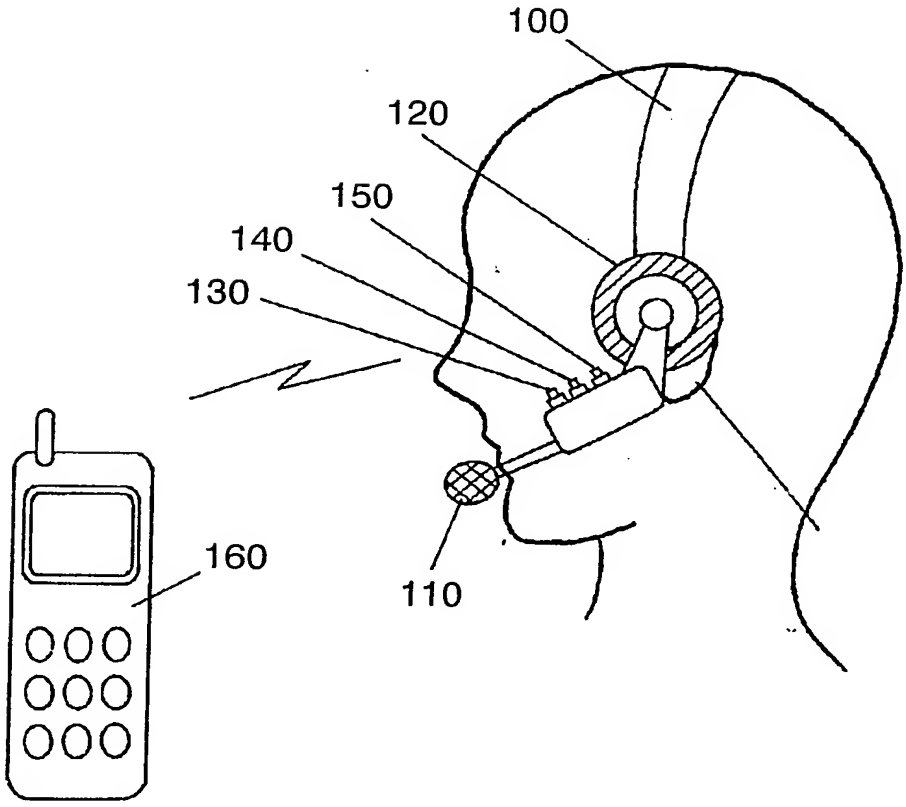


FIG. 6



Reference Numerals

1 Wireless Headset
2 Microphone
3 Loudspeaker
4 Cellular Telephone
5 Communication Section
6 Voice CODEC
7 First Amplifier
8 Second Amplifier
9 Controller
10 Storage Section
11 A/D Converter
12 D/A Converter
20 Wireless Headset
21 Bone Conduction Loudspeaker
30 Register Counter
31 Terminal Device

INTERNATIONAL SEARCH REPORT

International Application No
PCT/JP 02/13241

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04M1/60 H03G3/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04M H03G H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 01 78414 A (BUSSAN C ET AL) 18 October 2001 (2001-10-18) abstract page 3, line 11 -page 6, line 9 figures 1,2	1-26
Y	GB 2 336 073 A (SATOSHI B) 6 October 1999 (1999-10-06) abstract page 4, line 4 -page 5, line 12 page 13, line 1 -page 16, line 11 page 24, line 24 -page 26, line 4 claims 1-3 figures 1,6-8	1-7, 14-26

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
25 April 2003	12/05/2003

Name and mailing address of the ISA	Authorized officer
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6 084 967 A (KENNEDY P R ET AL) 4 July 2000 (2000-07-04) column 4, line 13 - line 20 column 6, line 13 - line 35	8-13
A	US 4 903 291 A (TSURUFUJI S ET AL) 20 February 1990 (1990-02-20) abstract column 2, line 40 - line 50 column 3, line 7 - line 33 claim 1 figure 1	1
A	WO 01 37262 A (TILLGREN M ET AL) 25 May 2001 (2001-05-25) abstract page 6, line 3 -page 7, line 10 page 11, line 9 - line 26 figures 1-6	1
A	EP 1 104 145 A (TAKEDA T) 30 May 2001 (2001-05-30) abstract paragraph '0012!	5-7
A	US 5 757 934 A (MASAMICHI Y) 26 May 1998 (1998-05-26) abstract column 4, line 1 - line 6 column 5, line 33 - line 59	18

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/JP 02/13241

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
WO 0178414	A	18-10-2001	AU	4790901 A	23-10-2001
			EP	1287675 A2	05-03-2003
			WO	0178414 A2	18-10-2001
GB 2336073	A	06-10-1999	JP	3225918 B2	05-11-2001
			JP	11284694 A	15-10-1999
			AU	2250099 A	14-10-1999
			GB	2351881 A ,B	10-01-2001
US 6084967	A	04-07-2000	NONE		
US 4903291	A	20-02-1990	JP	2005795 C	11-01-1996
			JP	7028330 B	29-03-1995
			JP	63226159 A	20-09-1988
WO 0137262	A	25-05-2001	US	6339706 B1	15-01-2002
			AU	1393601 A	30-05-2001
			CN	1390348 T	08-01-2003
			WO	0137262 A1	25-05-2001
			EP	1232493 A1	21-08-2002
EP 1104145	A	30-05-2001	JP	3322849 B2	09-09-2002
			JP	2000349879 A	15-12-2000
			AU	2689300 A	28-12-2000
			CA	2338207 A1	14-12-2000
			EP	1104145 A1	30-05-2001
			CN	1311942 T	05-09-2001
			WO	0076184 A1	14-12-2000
			TW	465247 B	21-11-2001
US 5757934	A	26-05-1998	JP	9172479 A	30-06-1997